Section 9.4.   Structural Requirements

9.4.1.   Structural Design Requirements and Application Limitations

9.4.1.1.   General

(See Note A-9.4.1.1.)

1) Subject to the application limitations defined elsewhere in this Part, structural members and their connections shall

- a) conform to requirements provided elsewhere in this Part,
- b) be designed according to good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction," or
- c) be designed according to Part 4 using the loads and deflection and vibration limits specified in
  - i) Part 9, or
  - ii) Part 4.

2) Where floor framing is designed in accordance with Clause (1)(b) or (c), and where supporting wall framing and fastenings, or footings, are designed according to Clause (1)(a), the maximum specified *live load* on the floor according to Table 4.1.5.3. shall not exceed 2.4 kPa.

3) Location-specific information for structural design, including snow and wind loads and seismic spectral response accelerations, shall be determined according to Subsection 1.1.3.

9.4.2.   Specified Loads

9.4.2.1.   Application

1) This Subsection applies to light-frame constructions whose wall, floor and roof planes are generally comprised of frames of small repetitive structural members, and where

- a) the roof and wall planes are clad, sheathed or braced on at least one side,
- b) the small repetitive structural members are spaced not more than 600 mm o.c.,
- c) the clear span of any structural member does not exceed 12.2 m,
- d) the maximum deflection of the structural roof members conforms to Article 9.4.3.1.,
- e) the maximum total roof area, notwithstanding any separation of adjoining *buildings* by *firewalls*, is 4 550 m², and
- f) for flat roofs, there are no significant obstructions on the roof, such as parapet walls, spaced closer than the distance calculated by

$$D_o = 10 \, (H_o - 0.8S_s / \gamma)$$

where

D_o = minimum distance between obstructions, m,

H_o = height of the obstruction above the roof, m,

S_s = ground snow load, kPa, and

γ = specific weight of snow, kN/m³.

(See Note A-9.4.2.1.(1).)

9.4.2.2.   Specified Snow Loads

(See Note A-9.4.2.2.)

1) Except as provided in Sentences (2) and (3), specified snow loads shall be not less than those calculated using the following formula:

$$S = C_b S_s + S_r$$

where

S = specified snow load,

C_b = basic snow load roof factor, which is 0.45 where the entire width of the roof does not exceed 4.3 m and 0.55 for all other roofs,

S_s = 1-in-50-year ground snow load in kPa, determined according to Subsection 1.1.3., and

S_r = associated 1-in-50-year rain load in kPa, determined according to Subsection 1.1.3.

2) In no case shall the specified snow load be less than 1 kPa.

3) Bow string, arch or semi-circular roof trusses having an unsupported span greater than 6 m shall be designed in conformance with the snow load requirements in Subsection 4.1.6.

9.4.2.3. Platforms Subject to Snow and Occupancy Loads

1) Balconies, decks and other accessible exterior platforms intended for an *occupancy* and subject to snow loads shall be designed to carry the specified roof snow load or 1.9 kPa, whichever is greater, where the platform, or each segregated area of the platform, serves a single *dwelling unit*. (See Note A-9.4.2.3.(1).)

9.4.2.4. Attics and Roof Spaces

1) The ceiling joists or truss bottom chords in residential *attic or roof spaces* having limited accessibility that precludes the storage of equipment or material shall be designed for a total specified load of not less than 0.35 kPa, where the total specified load is the sum of the specified *dead load* plus the specified *live load* of the ceiling. (See Note A-9.4.2.4.(1).)

9.4.3. Deflections

9.4.3.1. Deflections

1) The maximum deflection of structural members shall conform to Table 9.4.3.1.

2) *Dead loads* need not be considered in computing deflections referred to in Sentence (1).

Table 9.4.3.1.
Maximum Deflections
Forming Part of Sentence 9.4.3.1.(1)

Structural Members	Type of Ceiling Supported	Max. Allowable Deflection as an Expressed Ratio of the Clear Span
Roof rafters, roof joists and roof beams	No ceiling	1/180
	Other than plaster or gypsum board	1/240
	Plaster or gypsum board	1/360
Ceiling joists	Other than plaster or gypsum board	1/240
	Plaster or gypsum board	1/360
Floor beams, floor joists and floor decking	All cases	1/360
Beams, joists and decking for balconies, decks and other accessible exterior platforms	Serving a single *dwelling unit*	1/240
	Other	1/360

9.4.4. Foundation Conditions

9.4.4.1. Allowable Bearing Pressures

1) Footing sizes for *shallow foundations* shall be

a) determined in accordance with Section 9.15., or

b) designed in accordance with Section 4.2. using

    i) the maximum allowable bearing pressures in Table 9.4.4.1., or

    ii) allowable bearing pressures determined from *subsurface investigation*.

Table 9.4.4.1.
Allowable Bearing Pressure for Soil or Rock
Forming Part of Sentence 9.4.4.1.(1)

Type and Condition of *Soil* or *Rock*	Maximum Allowable Bearing Pressure, kPa
Dense or compact sand or gravel[1]	150
Loose sand or gravel[1]	50
Dense or compact silt[1]	100
Stiff clay[1]	150
Firm clay[1]	75
Soft clay[1]	40
Till	200
Clay shale	300
Sound *rock*	500

Notes to Table 9.4.4.1.:

(1) See Note A-Table 9.4.4.1.

9.4.4.2.   Foundation Capacity in Weaker Soil and Rock

1) Where a *soil* or *rock* within a distance equal to twice the footing width below the *bearing surface* has a lower allowable bearing pressure than that at the *bearing surface* as shown in Article 9.4.4.1., the design capacity of the *foundation* shall not be greater than would cause the weakest *soil* or *rock* to be stressed beyond its allowable bearing pressure.

2) In calculating subsurface pressures referred to in Sentence (1), the loads from the footings shall be assumed to be distributed uniformly over a horizontal plane within a frustum extending downward from the footing at an angle of 60° to the horizontal.

9.4.4.3.   High Water Table

1) Where a *foundation* bears on gravel, sand or silt, and the water table is within a distance below the *bearing surface* equal to the width of the *foundation*, the allowable bearing pressure shall be 50% of that determined in Article 9.4.4.1.

9.4.4.4.   Soil Movement

1) Where a *foundation* is located in an area where *soil* movement caused by changes in *soil* moisture content, freezing, or chemical-microbiological oxidation is known to occur to the extent that it will damage a *building*, measures shall be taken to preclude such movement or to reduce its effects on the *building* so that the *building's* stability and the performance of assemblies will not be adversely affected. (See Note A-9.4.4.4.(1).)

2) The potential for slope instability and its consequences, such as slope displacement, shall be evaluated based on site-specific material properties and ground motion parameters referenced in Subsection 1.1.3. and shall be taken into account in the design of the structure and its *foundations*.

9.4.4.5.   Retaining Walls

1) Walls shall be designed to resist the lateral pressure of the retained material.

9.4.4.6.   Walls Supporting Drained Earth

(See Note A-9.4.4.6. and 9.15.1.1.)

1) Except where constructed in accordance with Section 9.15., walls supporting drained earth shall be designed

a) for a pressure equivalent to that exerted by a fluid that has a density of not less than 480 kg/m³ and a depth equal to that of the retained earth, or

b) in accordance with Section 4.2. so as to be able to resist the loads and effects described in Article 4.1.2.1.

2) Walls supporting other than drained earth shall be designed

a) for the pressure described in Clause (1)(a) plus the fluid pressure of the surcharge, or

b) in accordance with Section 4.2. so as to be able to resist the loads and effects described in Article 4.1.2.1.